Long ago Newberry, and afterwards Stevenson, regarded the coal as metamorphosed by heat from a great dike of eruptive rock following the northerly side of the Placer (now Ortiz) mountain. This, which then was but a suggestion, is sufficiently clear as an explanation now. As the center of eruption was in the Ortiz mountains the metamorphism should be most notable near those mountains. That is distinctly the condition, for, at the most southerly point showing the *White Ash bed* well, the anthracite is very hard; but the change is less toward the north until normal coal is reached in the White Ash mine below Madrid. The gradation is equally clear in the *Cook-White bed*; but the small bed between the main seams appears to contradict the hypothesis, as it is decidedly bituminous at half a mile above the pit, where the *White Ash bed* yields the hardest anthracite observed. This condition is easily explained by the fact that the small bed is not continuous, being broken by clay seams several feet wide, which sometimes cut out all of the coal; these seams would prevent the passage of heat from one portion to another.

The conditions at several localities show that mere proximity to the mass of eruptive rock was insufficient to produce change. The lower plate of trachyte is but 10 feet below the *Waldo coal bed* in the bore-hole west from Coal cañon, but, though 200 feet thick, it had no appreciable effect upon the coal. The interval between the *White Ash bed* and the upper plate of trachyte shows insignificant variations along Coal cañon, and it must be approximately the same in the newer parts of the White Ash mine; yet in the Lucas mine and at all localities south from it the coal is anthracitic; whereas at all points north from it to the border of eruptive rock one finds only transition coal. It seems clear that direct contact is necessary to produce change.

Prof. J. F. Kemp describes the eruptive rock as a trachyte closely allied to andesyte. Its outflow then was early, possibly at the time of the Laramide elevation, when great outpourings of andesyte occurred in Colorado, Utah, Wyoming and Montana. The coal was completely formed prior to this elevation, prior to any disturbance, there being not only no evidence of pulpiness, but every evidence that the coal was thoroughly hard. It was crushed into minute fragments, slicken-sided, like the Utica shales of Franklin county, Pa., or laminated and rolled into leaves, like the Vespertine coals of southwestern Virginia. The process of conversation was complete before disturbance not merely in the lowest beds, but also in the *White Ash bed*, at nearly 900 feet above the bottom of the Laramie.

John J. Stevenson.

THE RÖNTGEN PHENOMENA.

A FEW EARLY RESULTS OBTAINED AT THE UNIVERSITY OF PENNSYLVANIA.

The first attempt here to repeat Röntgen's experiments was made on Wednesday, January 22d, but without success, owing to the impression obtained from early accounts of experiments abroad that two induction coils were necessary. As a matter of fact, one coil giving a four-inch spark through air is quite powerful enough to produce most of the results that have yet been obtained. The average current through the primary is about three amperes with an E. M. F. of twelve volts. Our tube is a beautiful large pear-shaped one, admirably adapted for the purpose. It is about 27 cm. long, and 11 cm. in diameter at the largest end.

Fig. 1 shows the result of a test to demonstrate the possible reflection or refraction of the X-rays when incident upon two very large and white diamonds set in a ring. The gems were placed within a purse with some coins. Certain features of the cutting

seem to be very marked, and the interpretation of the result obtained presents a very interesting problem.

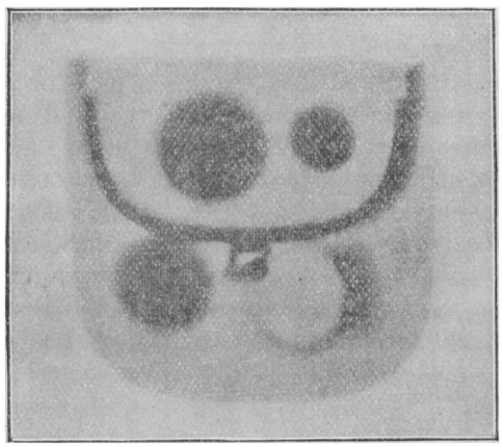

FIG. 1.

We have also demonstrated the possibility of detecting by the Röntgen process flaws or blow holes in metal plates. The writer had prepared for him three pieces of aluminum about 5 mm. thick, within which were made several hidden flaws and holes, and in one of them was placed a plug of some foreign substance, lead. A picture of the pieces reveals exactly the positions of all the holes, and a darker streak shows the position of the lead plug. Even the numbers which were stamped with a die are plainly visible in the radiogram.

It is now desired to call attention to a very interesting incident in connection with this wonderful discovery. The writer has in his possession a plate showing the impression of two coins taken on February 22, 1890, in the physical department of the University of Pennsylvania, undoubtedly by the X-rays.

On the occasion referred to many experiments were made, the object being to photograph the brush discharge, from a powerful induction machine, directly upon the sensitive plate, without any camera. Incidentally also the impressions of coins were obtained by sparking them when in contact with the sensitive film. After these experiments had been completed, a number of Crookes tubes were brought out and operated for the pleasure and amusement of Mr. W. N. Jennings, in connection with whom the work had been done.

A few days later Mr. Jennings, who had taken the plates home for development, reported the appearance, on one of them, of too very mysterious discs quite different in character from those obtained by the sparking process. No explanation was found at the time to account for the phenomenon, and the matter was forgotten till recently, when the occasion was recalled and the old plate was produced from a lot of so-called failures. On repeating the experiment by operating a Crookes tube for ten minutes, in the vicinity of an enclosed photographic plate having two coins on the outside of the box, it is found that the coin shadows are strikingly similar to the mysterious discs upon the old plate. The blurred appearance of one edge is a distinctive feature of a Röntgen picture. A print from the original plate is shown in Fig. 2. The writer and his associate wish

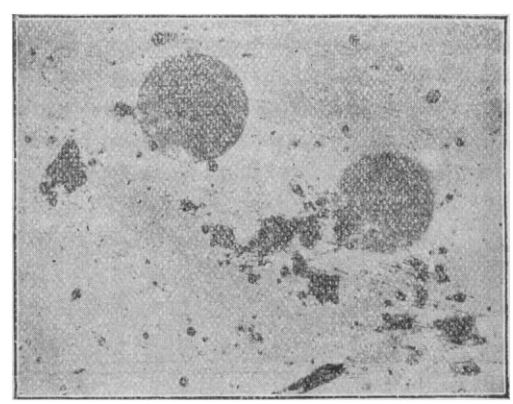

Fig. 2.

to claim no credit for the interesting accident, but the fact remains that without

doubt the *first* Röntgen picture was produced on February 22, 1890, in the physical lecture room of the University of Pennsylvania.

Arthur W. Goodspeed.
University of Pennsylvania.

CURRENT NOTES ON PHYSIOGRAPHY.

CATSKILL AND HELDERBERG ESCARPMENTS.

Recent reports of the New York State Geologist contain chapters by N. H. Darton, from which a number of interesting physiographic paragraphs may be selected; and inasmuch as there is no good account of the geography of the Empire State, all these piecemeal contributions toward it are welcome. The Helderberg escarpment in Albany county rises boldly over the broad alluvial plain formed by the Mohawk during the 'Champlain' submergence. Back of the escarpment the land rises in successive rock terraces of moderate height. The Catskill escarpment in Ulster county is the strongest feature of the kind in the eastern part of our country. Subordinate characteristics of this dominant form are found in the capture of the headwaters of certain consequent upland streams by the obsequent Kaaterskill and Plaaterskill, which are gnawing deep 'cloves' in the steep face of the escarpment and thus gaining drainage area for the subsequent Hudson valley. Among the ridges in the foreground the complicated monocline of Medina sandstone forming Shawangunk mountain is the most conspicuous. A number of geographical illustrations accompany these reports, but their reproduction is disappointing in several cases.

EXPLORATION IN LOWER CALIFORNIA.

An account of a collecting expedition to Lower California by G. Eisen (Proc. Cal. Acad. Sci., V., 1895, 733–775), gives some notes of interest on the features of the extremity of the peninsula. Winter rains are light and rare; late summer rains are frequent and come in comparatively heavy showers; the withered shrubby growth on the mountain slopes bursts into leaf and flower when the rains begin. Very brief mention is made of raised beaches and of 'moraines,' which are described as prominent, large and steep, especially on the east slope of the mountains, where they 'all run more or less parallel from west to east' (754). The mountains, being only 7,000 or 8,000 feet high, and their eastern slope being drier than the western, it seems questionable whether these so-called moraines are authentic records of glacial action. Possibly they are dissected alluvial fans, which have not infrequently been mistaken for glacial deposits.

NIUAFOU, A VOLCANIC RING ISLAND.

Lieut. Somerville, of the British navy, contributes an account of this remarkably perfect ring island to the London Geographical Journal for January. It lies midway between the Fiji and Samoa groups, remote from other islands. Its outer diameter is about three miles, the whole coast line consisting of forbidding black lava rocks. The caldera is about two miles in diameter, with interior cliffs of 200 or 300 feet in height. On the eastern side of the deep lake here contained is a peninsula formed by the craters of the eruption of 1886. The view from the commanding summits of the caldera ring is described as of remarkable beauty, including a great expanse of the surrounding ocean rolling under the southeast trade, the calm lake within the basin, the luxuriant vegetation on the older slopes, and the barren cinder cones of the recent outburst. A good sketch map and two views are reproduced.

THE FÆROES.

An account of the Færoes, or Sheep Islands, is presented to the same journal by Karl Grossmann, as the result of visits